THE PHYSIOLOGICAL ACTION OF COCA.

By ALEXANDER BENNETT, M.D.

In the recent numbers of the British Medical Journal, there have appeared several interesting notices on the therapeutical effects of "erythroxylon coca". This substance has been for some years pretty extensively employed at home, but particularly on the continent, as a stimulant and tonic in a variety of diseases, and, it is said, with considerable success. Still, comparatively little is yet known about the action of the plant. The following observations may not be uninteresting to those who are clinically investigating the properties of the drug, which, as our knowledge of it advances, will doubtless prove a valuable addition to the *Pharmacopœia*.

My attention was directed to the action of the coca leaves several years ago; and at different times, and from various sources, I have obtained quantities sufficient for experimental purposes. My object was first to ascertain the effects of the drug upon the healthy human subject, with special reference to its stated stimulant and antitriptic properties; and, with this object, I administered to myself and to others the leaves in doses varying from one to eight drachms in the form of infusion and of extract, and also by chewing them along with different alkalies, after the manner described by travellers as adopted by the natives of Bolivia and Peru. After a series of experiments carefully conducted, I was not able to convince myself that the drug thus administered had any special effects, with the exception of a sensation of slight local tingling of the tongue and mouth when the leaves were masticated for any length of time. Whether this inert action is due to the leaves having lost their active properties by exportation, to their being improperly selected or prepared, to an insufficient quantity having been administered, or to a defective method of application, I am not in a position to decide. After every precaution and variety of treatment with different samples of the leaves, and in as large quantities as could be conveniently administered, I have failed to satisfy myself that there was even any approach to the powerful and somewhat startling results graphically described by many authors as occurring when the leaves are chewed by the inhabitants of the countries where the plant abounds.

I next directed my attention to the neutral principle of the coca leaves, and after great difficulty, with the aid of Messrs. Macfarlane and Co., chemists, Edinburgh, I succeeded in obtaining a small quantity of the crystalline substance cocaine ($C^{16}H^{19}NO^4$). With this I conducted a series of experiments and observations on the lower animals, as far as I am aware, for the first time in this country, and arrived at results which appeared to me of considerable importance, ascertaining that cocaine was a powerful poison with special actions on the nervous system.

As coca is extensively employed in South America as a beverage, and as cocaine bears close chemical relations to the neutral principles of tea, coffee, guarana, chocolate, and other well known stimulants, I proceeded to make a series of experiments also with theine, caffeine, guaranine, and theobromine, with the view of determining the actions of each, and the relations, if any, which existed among them. In the *Edinburgh Medical Journal* for October 1873 will be found a description in detail of these observations. The general results at which I arrived may be given shortly as follows.

1. The physiological actions of coca, tea, coffee, guarana, and cocoa, are mainly, if not entirely, due to their neutral principles.

2. Cocaine, theine, caffeine, guaranine, and theobromine are powerful poisons, inducing a series of symptoms affecting the nervous, respiratory, circulatory, vaso-motor, and glandular systems, which terminate, if the dose be large enough, in death.

3. These five principles are, to all appearances, identical in physiological action.

4. In small doses not ending fatally, these five substances produce—*a*. Cerebral excitement not succeeded by coma, and *b*. Partial loss of sensibility.

5. In large doses they produce—*a*. Cerebral excitement, *b*. Complete paralysis of sensibility, *c*. Tetanic spasms and convulsions, and *d*. Death.

6. They paralyse the entire posterior columns of the spinal cord, also the entire system of peripheral sensory nerves; but the anterior columns of the cord and the peripheral motor nerves are not paralysed.

7. They frequently produce convulsions of a clonic character, but occasionally they cause tetanic spasms, which latter are sometimes so severe as to induce opisthotonus.

8. They do not produce muscular paralysis.

9. They at first increase, then impede, and lastly stop, the respirations.

10. They at first increase, and finally diminish, both the force and frequency of the heart's contractions.

11. They produce at first contraction, and afterwards dilatation, of the capillaries and small blood-vessels, with stasis of the blood, indicating first irritation, and subsequent paralysis, of the vaso-motor nerves.

12. They affect the temperature by first slightly lowering, and secondly increasing, it.

13. They usually produce contraction of the pupil.

14. They produce an increase of the salivary secretion.

15. They induce a peculiar form of tenesmus, accompanied by a copious discharge of clear mucus from the bowels.

These conclusions have been arrived at after a careful series of experiments conducted on more than one hundred animals of different kinds; and it is extremely interesting to learn that those agents, which the different nations of the world have found by experience to produce refreshing and stimulating beverages, although unlike one another and procured from totally different sources, possess in common proximate principles, which not only are almost identical in chemical composition, but also appear similar in physiological action.

According to the above observations, cocaine has the same actions as theine, etc.; so, for clinical purposes, the latter is at present preferable on account of the enormous expense of the former. That the effects of the beverages themselves are mainly, if not entirely, due to the neutral principles they contain, is highly probable; but of their beneficial action in medical practice I am not yet in a position to give an opinion. However, from their stimulant action and effect on the nervous system generally, there is every reason to hope that the concentrated forms of these drugs, or the neutral principles themselves, will prove powerful and useful agents in the hands of the physician for the treatment of disease.

Before the medical man can practise his profession scientifically, he should be acquainted, not only with the natural course of the malady he proposes to alleviate, but also with the physiological effects of the drug by which he hopes to reach this end. By observations upon the lower animals, he may also obtain suggestions and information which will materially assist him in relieving and benefiting the human being.

With this object, the above investigation was undertaken; and, although the research is yet in its infancy, I venture to hope that my conclusions will not be found deficient in interest and importance to those who desire to establish a sound system of therapeutics upon careful physiological experiment.

A CASE OF CHELOID SIMULATING MOLLUSCUM FIBROSUM.*

By H. CUNDELL JULER, M.D.

In performing a duty imposed upon me by the Academy of Medicine of Cincinnati, I proceed to a description of a very remarkable, although in this country by no means an unique, case of hypertrophic disease of the skin, occurring in a patient in the Cincinnati Hospital, June 24th, 1873. James Bell, a negro, the subject of this sketch, aged 43, unmarried, was born of slave parents, in the State of Tennessee. He appears to be well nourished and well developed, and states that his health has always been excellent. He was raised as a waiting-boy in the service of a family in Penala county, Mississippi, and was always treated by his master with great kindness, being well fed and comfortably bedded. He never received corporeal punishment. He never had any venereal affection. His mother, sister, and two brothers, are still living. He believes that his sister had a swelling in the form of "snakes", that extended from her neck to her face; but he never saw a person affected similarly to himself. He believes that a spell has been put upon him; and states that coloured doctors who had examined him and counted over fifty tumours under his clothes, had told him that somebody had put a turtle upon him. He has suffered from the present disease for thirty years, it having first appeared when about ten years of age, in a cicatrix following an abscess, in front of the lobule of the left ear. As the tumour increased in size, other integumentary sessile growths made their appearance upon different parts of the body, many of which slowly developed into pedunculated excrescences. The tumours are now present in all stages of growth, varying in size from a coriander seed to a mushroom in expansion, measuring several inches in diameter. They are of a lighter colour than the surrounding skin, becoming lighter by age. They are either distinct, grouped together, or several of them have coalesced. Manipulation gives rise to no uneasiness. The maple-tree wart-like excrescences stand out so sharply defined upon the surface of the skin, that an observer might at first sight suppose that the excrescences were

* Read before the Cincinnati Academy of Medicine.